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ABSTRACT

This document reports on research on the ability of a short-term intervention to substantially increase elementary pre-service teacher knowledge of major environmental science issues. The study was conducted each semester over seven years. Student understanding of such issues as global warming, ozone depletion, and local groundwater problems was investigated. The lack of sufficient student motivation to attend to the material presented during the intervention was hypothesized to be a major contributing factor causing this anomaly. The Spring, 2002 semester study added a motivator by notifying students that the lesson material would be on a future test in the course, which resulted in several modest gains in student performance. (KHR)

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Environmental Science Misconceptions - Resolution of an Anomaly

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Research on the ability of a short-term intervention to substantially increase elementary pre-service teacher knowledge of major environmental science issues has been conducted each semester over the past 7 years, with modest gains in student understanding of such issues as global warming, ozone depletion, and some local groundwater problems. However, the results of the Fall, 2001 semester study showed no gains. The lack of sufficient motivation to attend to the material presented during the intervention was hypothesized to be a major contributing factor causing this anomaly. The Spring, 2002 semester study added a motivator by notifying the students that the lesson material would be on a future test in the course, and this resulted in several modest gains in student performance.

The short-term intervention consisted of a 34 item pretest survey, followed by a 90 minute presentation by one of the researchers which included small group work to create concept maps depicting causal relationships, results of the environmental problem, and means to alleviate the problem. The researcher also met with each small group to check for comprehension, and to answer questions that the students had about the issues. The students were reminded during later class meetings that the material presented would be on an upcoming test. At the end of the semester, the students were given a post-test consisting of the same survey as for the pretest.

T-test of student performance revealed the following: for the ozone depletion issue, $p< 0.052$; for the global warming issue, $p<0.0002$; and for the local groundwater problems, $p<0.059$. The t-test for total results was $p<0.0001$. Scores increased for 21 of the survey items, while nine scores dropped. The overall pattern was the same as with earlier studies - students conflate cause-effect relationships and fail to develop an adequate conceptual understanding of these environmental issues, even though their factual knowledge increases to some degree. Although student performance increased significantly, they still showed a considerable lack of understanding of these issues. And, because they continue to hold misconceptions about these issues, they are likely to pass such misunderstandings along to their students. This is a serious matter, since these types of issues are included in several sections of the state's Science Framework, and form part of the knowledge base for the state's high stakes testing program.

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F. Groves

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ENVIRONMENTAL ISSUES MISCONCEPTIONS - SPRING, 2002									
	Pre- & Post-Test Score Comparisons								
		PRE-TEST				POST-TEST			
Student #	Group #1	Group #2	Group #3	Total		Group #1	Group #2	Group #3	Total
1	7	4	4	15		4	5	7	16
2	6	3	3	12		5	7	5	17
3	5	6	9	20		5	5	6	16
4	7	6	8	21		8	5	3	16
5	7	8	6	21		8	5	3	16
6	9	5	6	20		8	10	8	26
7	7	3	8	18		8	10	7	25
8	7	8	6	21		7	8	7	22
9	5	5	5	15		6	7	9	22
10	7	6	7	20		8	7	7	22
11	8	5	9	22		9	10	8	27
12	6	7	5	18		7	5	5	17
13	7	5	9	21		9	7	7	23
14	8	6	6	20		10	10	8	28
15	9	7	4	20		6	7	5	18
16	7	4	4	15		10	7	5	22
17	8	6	4	18		9	5	5	19
18	6	7	5	18		9	7	8	24
19	9	6	5	20		9	7	6	22
20	3	5	6	14		8	6	6	20
21	6	6	8	20		8	8	8	24
22	8	3	6	17		10	6	7	23
23	8	6	7	20		10	8	9	27
24	8	3	4	15		7	6	6	19
25	7	5	6	18		7	7	6	20
26	7	6	5	18		6	8	7	21
27	9	8	7	24		8	9	8	25
28	6	8	3	17		5	6	4	15
29	7	6	6	19		5	8	6	19
30	6	5	5	16		9	7	5	21
31	9	4	6	19		9	7	7	24
32	5	5	5	15		4	7	6	17
Average	7	5.53125	5.84375	18.34375		7.53125	7.09375	6.375	21.03125
T-Test, paired, equal variance						0.052147	0.000173	0.058735	0.000115

Environmental Issues Questionnaire

2001/2002

Scoring: A = I am sure this is right
B = I think this is right
C = I think this is wrong
D = I am sure this is wrong

1. If the ozone layer problem becomes worse, our weather will get hotter.
2. If the ozone layer problem becomes worse, more people will get skin cancer.
3. If the ozone layer problem becomes worse, there will be more air pollution for us to breathe.
4. If the ozone layer problem becomes wrose, more ultraviolet rays will reach the earth's surface.
5. The ozone layer problem is made worse by CFC (freon) gases entering the atmosphere.
6. The ozone layer problem is made worse by radioactive waste from nuclear power plants.
7. The ozone layer problem is made worse by acid rain.
8. The ozone layer problem is made worse by use of certain pesticides.
9. The ozone layer problem can be lessened by using unleaded gas.
10. The ozone layer problem can be lessened by stopping the use of CFC gases.
11. The ozone layer problem can be lessened by planting more trees.
12. The ozone layer problem can be lessened by using nuclear instead of coal power stations.

13. If the greenhouse effect gets stronger the earth will get hotter.
14. If the greenhouse effect gets stronger more people will get skin cancer.
15. If the greenhouse effect gets stronger some of our tap water will be unsafe to drink.
16. If the greenhouse effect gets stronger some of the ice at the earth's poles will melt.
17. The greenhouse effect is made worse because too many sun's rays get to the earth's surface.
18. The greenhouse effect is made worse by too much carbon dioxide in the air.
19. The greenhouse effect is made worse by holes in the ozone layer.
20. The greenhouse effect is made worse because the sun's rays cannot escape earth.
21. The greenhouse effect can be made smaller by keeping beaches clean.
22. The greenhouse effect can be made smaller by using nuclear instead of coal power stations.
23. The greenhouse effect can be made smaller by using unleaded gas.
24. The greenhouse effect can be made smaller by driving vehicles less.

25. Loss of water in the Sparta Aquifer is caused by global warming.
26. Loss of water in the Sparta Aquifer is caused by taking more water out of the ground than is going into the ground.
27. Loss of water in the Sparta Aquifer is caused mainly by homeowners overwatering lawns.
28. Loss of water in the Sparta Aquifer is caused by an increase in water pollution.
29. Groundwater pollution in northeast Louisiana comes mainly from natural causes.
30. Groundwater pollution in northeast Louisiana is caused mainly by human activity.
31. Northeast Louisiana rivers and bayous have always been muddy.
32. Northeast Louisiana rivers and bayous contained clear water until the 20th century.
33. Water pollution is a serious problem in northeast Louisiana.
34. Air pollution is a serious problem in northeast Louisiana.

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